

A REVIEW OF THE FISH GENUS NEOODAX (ODACIDAE) OF WESTERN AUSTRALIA WITH DESCRIPTION OF A CLOSELY ALLIED NEW GENUS AND SPECIES

JOHN K. SCOTT*

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ABSTRACT

The Western Australian Odacidae are reviewed. The family is comprised of ten species belonging to six genera. Of these *Odax*, consisting of the monotypic species *Odax pullus*, was not collected from this state; *Olisthops*, consisting of the distinctive species *Olisthops cyanomelas*, was not examined, and the related *Heteroscarus* and *Siphonognathus*, which are sometimes placed in separate families, are included in the key but not described in the text. The genera *Haletta* and *Sheardichthys* have been included in *Neoodax* as they are not outside the variability of this group, and a new genus is described to include odacids with canines and deeply notched dorsal fins.

Two species, *Neoodax beddomei* and *Neoodax attenuatus*, previously known from two specimens from Tasmania are described and figured. These two species with *Neoodax balteatus* are greatly extended in distribution. *Neoodax frenatus* is relegated to the synonymy of *Neoodax radiatus*. *Parodax caninus*, new species, is described from six specimens collected between Carnac and Rottnest Islands, Western Australia. It is separated from other odacids by the presence of canines, four pairs in the upper jaw and one pair in the lower jaw, a deeply notched dorsal, compressed snout, and 45 pored lateral line scales. Apart from the endemic *Parodax caninus* all Western Australian species have a southern Australian distribution.

INTRODUCTION

The family Odacidae contains six genera, including the following five which are monotypic: *Odax* Cuvier, 1829; *Olisthops* Richardson, 1850; *Heteroscarus* Castelnau, 1872; *Siphonognathus* Richardson, 1858; and *Parodax* described herein. The remaining species are included in *Neoodax* (sometimes mis-spelt *Neodax*) Castelnau, 1875. The members of the family are generally small fishes which inhabit shallow coastal seas of southern Australia and New

*Zoology Department, University of Western Australia.

Zealand. The group is well represented in Western Australia where all the species occur except *Odax pullus* (Bloch & Schneider 1801). Although Whitley (1948) included it in his checklist, the occurrence of this species outside New Zealand is doubtful.

Dr John R. Paxton of the Australian Museum, Sydney is currently studying the generic classification of the Odacidae.

There is some doubt regarding the inclusion of *Heteroscarus acropodus* (Richardson, 1846) and *Siphonognathus argyrophanes* Richardson, 1858. The remaining species not treated in this paper, *Olisthops cyanomelas* Richardson, 1850, appears to be closely allied to *Odax*, but is distinct on the basis of less scales in the lateral line and the absence of scales on the head.

All measurements were taken with needle point calipers to the nearest 0.1 millimetre (mm). Most of the measurements are self-explanatory. Body depth refers to the maximum depth; head length is measured from the posterior-most border of the opercular flap; standard length (SL) is measured from the tip of the upper jaw to the base of the caudal fin. The lateral line count includes all lateral line scales with pores. A summary of the counts for the dorsal fin rays and tubed lateral-line scales is presented in Tables 1 and 2.

Type specimens of *Parodax caninus* have been deposited at the Western Australian Museum, Perth (WAM); and the Australian Museum, Sydney (AMS).

KEY TO THE SPECIES OF WESTERN AUSTRALIAN ODACIDAE

- 1a. Pelvic fin absent; lateral line count about 100; thin filament attached to the anterior most edge of the upper lip; body elongated (Western Australia, South Australia, Victoria)
..... *Siphonognathus argyrophanes*
- 1b. Pelvic fin present; lateral line count less than 90; no filaments on the lips; body moderately compressed to elongate
..... 2
- 2a. Jaws with canine teeth; dorsal fin deeply notched at soft dorsal junction; snout compressed and pointed (Western Australia)
..... *Parodax caninus*

2b. Jaws without canine teeth; dorsal fin notch present or absent; snout blunt to elongated 3

3a. Pored lateral line scales 30 to 32; spinous dorsal rays XV; first three dorsal spines produced in male (Western Australia, South Australia, New South Wales) *Heteroscarus acroptilus*

3b. Pored lateral line scales 36 or more; only first dorsal spine produced or elongate spines absent 4

4a. Snout blunt; dorsal moderately notched at soft dorsal junction; head mostly naked; pored lateral line scales 48 to 50; caudal fin emarginate, outer rays may be produced (Western Australia, South Australia, Victoria, New South Wales, Tasmania, Queensland) *Olisthops cyanomelas*

4b. Snout pointed; dorsal fin without notch or only slightly notched at soft dorsal junction; head with scales on operculum; pored lateral line scales more than 50 or less than 47; caudal fin rounded or lanceolate 5

5a. Pored lateral line scales 56 to 63; margin of preoperculum serrated (less obvious in larger specimens); caudal fin rounded (Western Australia, South Australia, Victoria, Tasmania, New South Wales) *Neoodax semifasciatus*

5b. Pored lateral line scales less than 50; margin of preoperculum serrated or entire; caudal fin rounded or lanceolate 6

6a. Pored lateral line scales 36 to 39; margin of preoperculum serrated; caudal fin rounded, dorsal spines XIV to XVI (Western Australia,

South Australia, Victoria, Tasmania, New South Wales) *Neoodax balteatus*

6b. Pored lateral line scales 40 to 45; margin of preoperculum entire; caudal fin lanceolate; dorsal spines XVII to XXI 7

7a. Snout triangular, 2.5 to 2.9 in head length; caudal fin without a conspicuous black spot; first dorsal spine and first pelvic ray may be greatly produced (Western Australia, South Australia, Tasmania) *Neoodax radiatus*

7b. Snout rounded or elongate, less or greater than 2.5 to 2.9 in head length; caudal fin with a conspicuous black spot; no dorsal or pelvic rays produced 8

8a. Snout short, 3.2 to 4.2 in head length; head relatively short, its length 3.9 to 4.3 in standard length (Western Australia, Tasmania) *Neoodax attenuatus*

8b. Snout compressed and elongated, 1.8 to 1.9 in head length; head relatively elongate, 2.7 to 2.9 in standard length (Western Australia, Tasmania) *Neoodax beddomei*

Genus *Neoodax* Castelnau

Neoodax Castelnau (1875) Vict. Off. Rec. Philad. Exhibition 1875:37 (type species *Neoodax waterhousii* (=*N. balteatus*) by original designation). *Haletta* Whitley (1947) Aust. Zool. 11:146 (type species *Odax semifasciatus* by original designation).

Sheardichthys Whitley (1947) Aust. Zool. 11:146 (type species *Neoodax radiatus* by original designation).

Diagnosis

Dorsal rays XIV to XXI, 10 to 14; anal rays III, 10 to 12; pectoral rays 12 to 14; pelvic rays I, 4; branched caudal rays 10; body moderately slender to elongate, the depth 5.0 to 11.0 in standard length; head length 3.0 to 4.0 in standard length; snout short to elongate; mouth small, terminal; lips moderately fleshy; teeth fused except for a narrow gap dividing the upper row of teeth; operculum scaled; preoperculum sometimes naked; no scales on fins except basally on caudal; body scales cycloid; lateral line continuous with 36 to 64 pored scales; margin of preoperculum entire or serrated; gill membranes broadly attached to isthmus; gill rakers short and triangular, 10 to 12 on first branchial arch.

Colour in alcohol generally brown dorsally and lighter on the ventral half; one to several dark bands frequently present on head; fins translucent, occasionally with banding; caudal sometimes with dark spot; base of dorsal fin sometimes with black longitudinal band.

Colour in life variable but usually green or brown (occasionally red), frequently with blue lines on head and fins in adults; juveniles with red spots on ventral half of body and with transparent fins.

Remarks

Neoodax was established by Castelnau to include *Odax* species with 'a serrated operculum and soft vertical fins'. Since then most authors have included all Australian odacids in this genus except *Olisthops cyanomelas* and *Neoodax semifasciatus*.

Whitley (1947) placed *N. semifasciatus* in *Haletta* distinguishing it on the base of 'having more than 50 . . . transverse rows of scales . . . preoperculum entire, the caudal fin rounded . . .'. However the magnitude of these differences seems relatively unimportant at the generic level. Therefore I prefer to include *Haletta* as a junior synonym of *Neoodax*.

Neoodax species are typically inhabitants of the shallow coastal marine angiosperm communities. In the case of *Neoodax radiatus* and *Neoodax balteatus* they are the dominant fish species in this habitat in W.A.

Neoodax semifasciatus and *Neoodax balteatus* are known to occur in all southern states of Australia. *Neoodax radiatus* is reported as rare throughout its distribution while *Neoodax attenuatus* and *Neoodax beddomei* have only been reported previously from Tasmania.

Neoodax balteatus Valenciennes
(Fig. 1; Tables 1 & 2)

Odax balteatus Valenciennes (1839:303) (Type locality ? Tasmania).
Günther (1862:241) (Port Arthur, Tasmania; Port Jackson, New South Wales); Macleay (1881:106) (Tasmania; Port Jackson, New South Wales).

Odax algensis Richardson (1840:26) (Port Arthur, Tasmania); Richardson (1849:148) (Port Arthur, Tasmania).

Odax obscurus Castelnau (1872:154) (Melbourne, Victoria); Macleay (1881:108) (Port Phillip, Victoria).

Neoodax waterhousii Castelnau (1875:37) (Adelaide, South Australia); McCulloch (1929:324) (South Australia).

Odax waterhousii.— Macleay (1881:109) (South Australia).

Odax brunneus Macleay (1881:109) (Port Jackson, New South Wales).

Neoodax balteatus.— McCulloch (1922:100) (Port Jackson, New South Wales); Lord & Scott (1926:12,76) (Tasmania). Whitley (1929:58) (Jordan 'River', Tasmania); McCulloch (1929:324) (New South Wales, Tasmania, Victoria); Scott (1966:100) (Buckingham, Tasmania).

Neoodax obscurus.— McCulloch (1922:100); McCulloch (1929:324) (New South Wales, Victoria).



Fig. 1: *Neoodax balteatus*, 69 mm SL, Cockburn Sound, Western Australia.

Diagnosis

Dorsal rays XV to XVI, 12 to 14; anal rays III, 11 to 12; pectoral rays 12 to 14; pelvic rays I, 4; branched rays in caudal fin, 10; lateral line scales 37 to 38; preoperculum serrated; body depth 4.5 to 5.7 in SL; head length 3.0 to 3.2 in SL; snout 2.5 to 3.5 in head length; eye 1.2 to 1.6 in snout length; interorbital width 1.2 to 1.7 in snout length; dorsal fin base 1.8 to 2.0 in SL; anal fin base 4.3 to 4.7 in SL; pelvic fin length 2.4 to 3.0 in head length; pectoral fin length 2.0 to 2.8 in head length; first dorsal spine 1.2 to 2.3 in snout, remaining spines about equal in length; first anal spine 2.0 to 4.0 in snout length, about half the length of second spine which is less than the third spine; first pelvic ray not greatly extended; caudal fin truncate to slightly rounded.

Colour in alcohol: brown dorsally, separated from the lighter ventral half by a dark band, passing above the upper lip through the ventral half of the eye to the caudal (this band may be absent); small dark patches over the body except between lower jaw and anal fin; fins either colourless or with some dark spots.

Colour of live specimens: basically green or brown, occasionally grey. In green and brown specimens a dark band passes from the tip of the snout, above the lips, and ends at the caudal fin base (in darker specimens this may be obscured); in green specimens the dorsal, anal and caudal fins green, the remainder colourless; fins on brown specimens colourless. Grey specimens may have a dark longitudinal band on middle of sides; ventrally whitish-silver with scales edged in grey; dorsal fin with alternating bands of red, brown and white (larger specimens may have red and blue bands which fade posteriorly); caudal orange basally or with red and brown vertical bands; larger specimens sometimes with red and blue bands on the anal and ventral fin and a series of blue or orange lines on the head, three to six on the snout, some continuing onto the operculum.

Remarks

The types of *N. algensis* were examined by Günther (1862) and found to be identical with *N. balteatus*. Whitley (1964) also relegated *N. obscurus* and *N. waterhousii* to junior synonyms of *N. balteatus*.

The description of *O. brunneus* included scale counts of 30 but on re-examination of the holotype, McCulloch (1922) found counts of 38-39 and concluded that the specimen was *N. balteatus*.

The holotype of *N. balteatus* - MNHN 2190, 80 mm SL, was examined at the Muséum National d'Histoire Naturelle, Paris, on behalf of the author by

Table 1: Fin ray counts for species of *Neoodax* and *Parodax*.

	Dorsal Spines							Dorsal Rays							
	XIV	XV	XVI	XVII	XVIII	IXX	XX	XXI	10	11	12	13	14	15	
<i>Neoodax semifasciatus</i>									11	12	1	1	6	12	4
<i>N. radiatus</i>									6	12	7	1	4	11	11
<i>N. beddomei</i>									1	3			2	2	
<i>N. attenuatus</i>									1	1		2			
<i>N. balteatus</i>									1	11	14		1	19	4
<i>Parodax caninis</i>									4	2		2	4		

Table 2: Lateral line scale counts of *Neoodax* and *Parodax*

36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64

<i>Neoodax semifasciatus</i>	4	4	2	3	3	3	4
<i>N. radiatus</i>	5	10	12	6			
<i>N. beddomei</i>	1	2	1				
<i>N. attenuatus</i>	1	1					
<i>N. balteatus</i>	2	3	11	1			
<i>Parodax caninis</i>	6	3	2				

G.R. Allen. It was collected by Pérón. There are no collecting data but as McCulloch (1929) suggests, the locality was probably Tasmania.

N. balteatus occurs from southwest Australia to New South Wales. In Western Australia it is an inhabitant of seagrass beds at depths between 3 to 10 metres. The stomach and gut contents of 19 specimens, 46 mm to 90 mm SL, contained mainly crustaceans (largely shrimps and amphipods) and small molluscs.

Material examined

34 specimens, 37-122 mm SL.

Western Australia

Cockburn Sound — WAM P25258, 2, 57-69 mm; WAM p25350, 2, 67-70 mm; WAM P25257-003, 2, 43-64 mm; WAM P25358-001, 1, 70 mm; WAM P22192, 1, 99 mm; WAM P22193, 1, 93 mm; WAM P295, 2, 78 mm.

Carnac Island — WAM P21561, 1, 99 mm; WAM 25355-001, 1, 61 mm; WAM P21560, 6, 49-74 mm.

Oyster Harbour — WAM P25356-001, 1, 71 mm; WAM P25357-001, 1, 59 mm; WAM P21761, 1, 50 mm.

South Australia

No data — AMS B228, 3, 102-112 mm.

Tasmania

Hobart — AMS I14206, 7, 37-77 mm; WAM P25359-001, 1, 41 mm.

New South Wales

Sydney — AMS I16799-016, 1, 75 mm.

Neoodax attenuatus Ogilby

(Fig. 2; Tables 1 & 2)

Odax attenuatus Ogilby (1897:83) (Type locality, Tasmania).

Neoodax attenuatus. — McCulloch (1929:324) (Tasmania); Scott (1974:280, fig. 2, p.282) (Promise Bay, Glamorgan, Tasmania).

Diagnosis

Dorsal rays IXX to XX, 14; anal rays III, 8 to 9; pectoral rays 12 to 13; pelvic rays I, 4; branched rays in caudal fin 10; lateral line scales 40 to 42;

preoperculum entire; body depth 9.9 to 10.8 in standard length; head length 3.9 to 4.3 in standard length; snout 3.2 to 4.2 in head length; eye 0.8 to 1.1 in snout length; interorbital width 1.0 to 1.1 in snout length; dorsal fin base 1.7 to 1.8 in standard length; anal fin base 1.7 to 2.4 in head length; pelvic fin length 2.7 to 3.5 in head length; pectoral fin length 2.0 to 2.7 in head length; first dorsal spine 1.0 in snout, the rest about equal; first anal spine, being 0.9 in the snout, one third the second spine which is less than half the third spine; first pelvic ray not greatly produced; caudal fin lanceolate.

Colour in alcohol: brown dorsally, fading to yellow below; snout brown dorsally, becoming darker on interorbital; nape lighter; caudal fin pale except for a prominent black spot on upper portion, upper and lower margin of fin black basally and also outer edge of middle caudal rays black; remaining fins colourless.

The basic colour of fresh specimens is red-brown with a prominent black spot on the caudal fin.



Fig. 2: *Neoodax attenuatus*, 75 mm SL, (from Scott, 1974).

Remarks

The type of this species was originally lodged in the Tasmanian Museum, Hobart (Ogilby, 1897), but was not included in the recent list (Andrews, 1971) of fish types from there. Only one other specimen is known from the literature (Scott, 1974). It was taken in Tasmania, but apparently was not deposited in a museum collection and has not been examined by the author.

This species was previously known only from Tasmania.

The two specimens listed below were caught by beam trawl in a bed of the marine angiosperm *Posidonia australis*. In spite of extensive trawling in

this habitat no further specimens have been obtained. Thus, the species is either rare in Western Australia or normally occurs in a different habitat.

Material examined

2 specimens, 47-69 mm SL.

Western Australia

Geographe Bay — WAM P21553, 1, 47 mm; WAM P21554, 1, 69 mm.

Neoodax beddomei Johnston
(Fig. 3; Tables 1 & 2)

Odax beddomei Johnston (1885:231) (Type locality, Derwent River, Tasmania); Ogilby (1897:84) (Tasmania).

Neoodax beddomei.— Lord & Scott (1924:12,76) (Tasmania); Scott (1969:163, fig. 1a,b,c, p.169) (between Flinders and Cape Barren Islands, Tasmania).

Siphonognathus beddomei.— McCulloch (1929:325) (Tasmania); Whitley (1929:59, pl. IV, fig. 6) (Tasmania).



Fig. 3: *Neoodax beddomei*, 98 mm SL, Carnac Island, Western Australia.

Diagnosis

Dorsal rays XVIII to IXX, 11 to 12; anal rays III, 11 to 12; pectoral rays 12 to 14; pelvic rays I, 4; branched rays in caudal fin, 10; lateral line scales 40 to 42; preoperculum entire; body depth 9.6 to 10.4 in standard length; head length 2.7 to 2.9 in standard length; snout elongated 1.8 to 1.9 in head length; eye 3.1 to 3.8 in snout length; interorbital width 3.3 to 4.5 in

snout length; dorsal fin base 2.1 to 2.3 in standard length; anal fin base 8.5 to 9.8 in standard length; pelvic fin length 2.8 to 3.5 in head length; pectoral fin length 3.1 to 3.4 in head length; first dorsal spine 4.4 to 5.4 in head length, just shorter than second and third spine but longer than 14th to 16th spine; thus forming a shallow notch; posterior dorsal rays the longest; first anal spine less than half first dorsal spine and a third of second anal spine which is less than the third anal spine; first pelvic spine less than second and third; caudal fin lanceolate.

Colour in alcohol: light green dorsally, ventral pale brown becoming lighter on both snout and tail; dark lines sometimes present on snout and operculum; small black spot on upper portion of caudal fin, remaining fins colourless.

Colour in life: dark green dorsally with ventral half pale brown to yellow; a series of dark bands radiating from snout, one extending to lower edge of eye, another to upper anterior edge of eye, and another series of three mid-dorsally between snout tip and interorbital; two rows of small spots originating at eye and passing along body to base of caudal fin, lower row not continuous, ending at preoperculum and re-commencing as a faint row along the posterior half of the body. Dorsal fin greenish-yellow, with red patches basally and distally on membranous portion; anal, pelvic, pectoral, and posterior dorsal fin rays reddish; caudal fin with conspicuous black spot on three uppermost branched rays, remainder of fin red, lighter posteriorly.

Remarks

This species has been variously placed in the Odacidae and Siphonognathidae by previous authors, but as Scott (1969) points out, the absence of ventral fins in the original description and in Johnston's drawing of the type (Whitley, 1929, pl. IV, fig. 6) is probably an oversight.

The type was deposited in the Tasmanian Museum, Hobart, but appears to have been lost (Lord & Scott, 1924). Andrews (1971) does not include this species on the list of types for the same institution. Only one other specimen was previously reported (Scott, 1969), but apparently it was not deposited in a museum collection.

This species was previously known only from Tasmania.

N. beddomei is associated with patches of weed, principally marine angiosperms, which occur in small clumps (less than 6 m diameter) in sand amongst limestone reefs (depth 10-12 metres). The species swims above the weed in small groups (usually of three to five individuals of varying sizes). They quickly seek shelter in the weeds if disturbed.

Material examined

4 specimens, 53-98 mm SL.

Western Australia

Carnac Island — WAM P25224-002, 2, 53-98 mm; WAM P25297-005, 1, 90 mm.

Canal Rocks — WAM P25150-001, 1, 90 mm.

Neoodax radiatus (Quoy & Gaimard)

(Fig. 4; Tables 1 & 2)

Malacanthus radiatus Quoy & Gaimard (1835:717, pl. XIX, fig. 2) (Type locality, King Georges Sound, Western Australia).

Cheilio lineatus Valenciennes (1839:354) (King Georges Sound, Western Australia).

Odax lineatus Richardson.— (1848:133, pl. LX, fig. 1-5) (King Georges Sound, Western Australia).

Odax frenatus Günther (1862:241) (Fremantle Gage Roads, Swan River, Western Australia); Castelnau (1873:72) (South Australia); Macleay (1881:107) (Western Australia).

Odax radiatus.— Günther (1862:242) (Fremantle, Western Australia); Castelnau (1873:71) (South Australia); Macleay (1881:108) (Port Phillip, Victoria).



Fig. 4: *Neoodax radiatus*, 120 mm SL, Cockburn Sound, Western Australia.

Odax pusillus Castelnau (1873:72) (South Australia); Macleay (1881:108) (South Australia).

Neoodax pusillus.— McCulloch (1929:323).

Neoodax radiatus.— Scott (1962:282) (South Australia, Western Australia); Scott (1964:97) (Tasmania); Scott (1966:100) (Tasmania).

Neoodax frenatus.— Scott (1962:282) (South Australia, Western Australia); Scott (1966:100) (Tasmania); Scott, Glover & Southcott (1974:314) (South Australia, Western Australia).

Neoodax (Sheardichthys) radiatus.— Whitley (1947:146).

Diagnosis

Dorsal rays XVIII to XX, 10 to 12; anal rays III, 9 to 11; pectoral rays, 12 to 13, ventral rays I, 4; branched rays in caudal fin, 10; lateral line scales 41 to 43; preoperculum not serrated; body depth 5.7 to 7.0 in standard length; head length 3.2 to 3.6 in standard length; snout 2.5 to 2.9 in head length; eye 1.5 to 2.1 in snout length; interorbital width 1.5 to 2.0 in snout length; dorsal fin base 1.7 to 2.0 in standard length; and fin base 5.0 to 6.7 in standard length; pelvic fin length 2.0 to 2.6 in head length for specimens below 120 mm SL; specimens above this size pelvic length is up to 1.2 in head length; pectoral fin 2.3 to 2.8 in head length; in specimens over 120 mm SL, the first dorsal spine is greatly produced, up to 1.6 in head length, the second is less than first and greater than third and following spines; in specimens below 120 mm SL the first dorsal spine is less or equal to the second and other spines; in specimens above 120 mm SL the first pelvic ray is greatly produced to 1.2 in head length, the second pelvic ray just greater than or equal to the pelvic spine; in specimens below 120 mm SL the first pelvic ray is not greatly extended; first anal spine is half the second which is just less than the third; caudal fin lanceolate.

Colour of juveniles and females in alcohol: dark dorsally, paler below, with some dark patches on ventral half; dark band from snout passing through eye and fading on operculum; fins colourless except caudal which may be tinged with dark brown. Males exhibit the same basic colour pattern with the following additions: a series of lines with darkened margins on head; dorsal fin with prominent longitudinal dark band basally between 6th to 13th rays, membranes on anterior half of fin with series of dusky bands fading posteriorly; pectoral and anal fins colourless; pelvic and caudal fins sometimes dusky between rays.

Colour of females and juveniles in life: green or brown with a dark band extending from the upper lip, through the eye, and fading on the operculum. Juveniles are generally green, brown or red dorsally, whitish ventrally, with

red spots, particularly under the head; fins colourless; a dark band sometimes extending from snout to operculum.

Colour of males in life: dark green dorsally becoming lighter to yellow ventrally; a series of faint blue lines and grey, brown and green blotches on dorsal half of body; ventral portion of body with six blue lines; head dark green with series of light green lines; membrane between first two dorsal spines brown; anterior portion (to about 10th ray) of soft dorsal fin with alternating blue and yellow longitudinal bands; broad blackish streak bordered above with orange at base of 8th to 16th dorsal rays; posterior portion of dorsal translucent; caudal fin yellow with blue lines from body extending onto basal part; pectoral fin translucent; pelvic fins yellow with membrane between first and second rays dusky; anal fin mostly yellow, pink posteriorly with 2 or 3 blue longitudinal lines extending to about sixth ray.

Remarks

Neoodax radiatus was described on the basis of a drawing done during the voyage of the *Astrolabe* (mid 1820s). The potential type was apparently lost or destroyed. The drawing of this species by Richardson (1848) is frequently reproduced (Scott, 1962; Scott, Glover & Southcott, 1974) but contains several inadequacies, particularly with reference to the lower number of scales on the lateral line.

This species shows marked sexual dimorphism. The colourful male is readily distinguished by the black band at the base of the 8th to 16th dorsal ray. The first dorsal and second pelvic fin ray are produced, sometimes equalling the head length in the case of the pelvic. The less colourful female form was considered to be a separate species, *N. frenatus*, by Günther (1862) and later authors.

N. radiatus occurs from Western Australia to Tasmania.

This species is principally found in beds of seagrass in 3 to 10 metres depth. The stomach and gut contents of 20 specimens, 53 mm to 130 mm SL, contained mostly crustaceans (mainly shrimps and amphipods) and molluscs.

Material examined

88 specimens, 34-135 mm SL.

Western Australia

Carnac Island — WAM P25341-001, 1, 77 mm; WAM P25297-001, 12, 34-111 mm; WAM P5890, 21, 64-85 mm; WAM P25343-009, 1, 130 mm.

Rockingham, Cockburn Sound — WAM P25257-001, 164 mm; WAM P25365, 1, 98 mm; WAM P25258-008, 3, 68-128 mm.

Geographe Bay — WAM P25259-001, 29, 16-85 mm; WAM P20926, 7, 56-102 mm; WAM P25364-001, 1, 121 mm; WAM P20934, 1, 121 mm; WAM P25362-001, 1, 100 mm.

King Georges Sound — WAM P25361-001, 1, 91 mm; WAM P24842, 1, 125 mm; WAM P5637, 2, 128-132 mm; WAM P25360-001, 1, 135 mm.

Cottesloe, Perth — WAM P823, 1, 110 mm.

Warnbro Sound — WAM P23260, 1, 107 mm.

Yallingup — WAM P4960, 1, 116 mm.

No data — WAM P25362-001, 1, 116 m.

South Australia

Investigator Strait — AMS I12388, 1, 121 mm; AMS I12387, 1, 121 mm; AMS I12389, 1, 103 mm; AMS I12390, 1, 74 mm.

Neoodax semifasciatus

(Fig. 5; Tables 1 & 2)

Odax semifasciatus Valenciennes (1839:299. pl. CCCCVII) (Type locality, Indian Ocean ?); Günther (1862:241) (no locality); Macleay (1881:107) (Port Jackson, New South Wales).

Odax richardsonii Günther (1862:241 & 509) (Port Jackson, Hobson's Bay, New South Wales); Castelnau (1873:72) (South Australia); Macleay (1881:107) (Port Phillip, Victoria); Waite (1900:211) (Swan River,



Fig. 5: *Neoodax semifasciatus*, 243 mm SL, Geographe Bay, Western Australia.

Perth, Western Australia); Waite (1905:71) (Houtman's Abrolhos, Western Australia).

Odax hyrtlii Steindachner (1866:464, pl. V, fig. 4) (Port Jackson, New South Wales).

Neoodax semifasciatus.— McCulloch (1929:323) (Tasmania, New South Wales, Victoria, Western Australia, South Australia).

Haletta semifasciatus.— Whitley (1946:146) (Western Australia); Scott (1962:281, unnumbered fig.) (South Australia); Scott (1966:102) (Dorset, Devon, Tasmania); Scott, Glover & Southcott (1974:313) (Western Australia, South Australia, Victoria, New South Wales, & Tasmania).

Diagnosis

Dorsal rays XVII to XVIII, 12 to 14; anal rays III, 10 to 12; pectoral rays 14 to 15; pelvic rays I, 4; branched rays in caudal fin, 10; lateral line scales 53 to 63; preoperculum serrated, obscured in some adults; body depth 5.0 to 6.0 in standard length; head length 2.9 to 3.4 in standard length; snout 2.3 to 3.0 in head length; eye 2.2 to 2.7 in snout length; interorbital width 1.8 to 2.6 in snout length; dorsal fin base 1.8 to 2.1 in standard length; anal fin base 5.1 to 6.0 in standard length; pelvic fin 2.3 to 3.0 in head length; pectoral fin 1.9 to 2.4 in head length; first dorsal spine 2.2 to 3.4 in snout length, the rest about equal; longest ray, twenty sixth, 1.0 to 2.0 in snout length; first anal spine 5.0 to 7.0 in snout length, less than a third of second, which is less than the third; first pelvic ray not greatly produced; caudal fin truncate to rounded.

Colour in alcohol: dark dorsally with six to seven dark bars extending onto lighter ventral region; head sometimes with narrow lines, especially around eye except on upper dorsal edge; fins translucent except a few individuals with dark band on dorsal fin base.

One specimen, 226 mm SL, male, showed some colour retention in alcohol: dark dorsally with seven dark bars extending into ventral region; lateral side of head with irregular green lines with dark borders, lines fade ventrally; snout to interorbital dark brown; dorsal fin with alternating green and brown bands, one black band on mid-dorsal fin base; anal fin with alternating green and brown bands; caudal fin green; pectoral and pelvic fins translucent.

Colour in life: basically blue-green, dark dorsally with six to seven vertical bands fading ventrally; side of body with orange scales; head dark dorsally, white ventrally, blue and orange lines on cheek, operculum blue, upper lip dusky, lower pale; dorsal fin with orange and blue horizontal

lines, 7 to 8 in all; dark blotch from last spine to 7th ray sometimes present; anal fin with blue and orange horizontal lines, 4 to 5 in all, membrane grey distally; caudal fin with blue background with orange markings, grey distally; pectoral fin translucent, rays light orange; pelvic fin translucent, rays light orange.

The juveniles of *N. semifasciatus* (approx. 37 to 110 mm SL) are similar in appearance to *N. balteatus*, but are readily distinguished by the presence of faint vertical bands and an obvious blue spot surrounding the vent.

Remarks

The holotype — MNHN 2191, 209 mm SL, was examined at the Muséum National d'Histoire Naturelle, Paris on behalf of the author by G.R. Allen.

This is the largest member of the genus and appears to be distributed throughout the coastal waters of southern Australia. It frequents weed beds as a juvenile and occasionally as an adult. Specific adult habits and food preferences are not known.

Material examined

26 specimens, 37-264 mm SL.

Western Australia

Cockburn Sound — WAM P25378-001, 1, 81 mm; WAM P11, 2, 121-168 mm; WAM P4694, 2, 175-215 mm.

Fremantle — WAM P2226, 1, 216 mm; WAM P3698, 1, 264 mm; WAM P3699, 1, 256 mm; WAM P3700, 1, 226 mm.

Scarborough, Perth — WAM P3190, 1, 222 mm.

Geographe Bay — WAM P21009, 1, 37 mm.

Hardy Inlet — WAM P25275-005, 1, 125 mm; WAM P24403, 3, 111-117 mm.

King Georges Sound — WAM P4557, 1, 214 mm; WAM P5031, 3, 215-250 mm; WAM P5636, 2, 181-251 mm; WAM P20189, 1, 237 mm.

No data — WAM P25379-001, 1, 193 mm; WAM P25393-001, 1, 113 mm.

South Australia

Investigator Straits — AMS I12385, 1, 228 mm; AMS I12386, 1, 222 mm.

Genus *Parodax* new genus

Diagnosis

Dorsal fin deeply notched, rays XV to XVI, 12 to 13; anal rays III, 10 to 11; pectoral rays 12; pelvic rays I, 4; branched caudal rays 10; lateral line scales 45, continuous, one pored scale beyond base of caudal fin; gill rakers on first branchial arch 10; gill membranes broadly attached to isthmus; body with cycloid scales; head naked except for an occasional two scales on preoperculum; no scales on fins except for sheath at caudal fin base; head with numerous pores; posterior nostril at upper anterior edge of eye; a pupil length to anterior nostril, tubed with posterior flap; mouth small and terminal; lips moderately fleshy; upper jaw with two rows of teeth which fuse basally; inner row fused, individual teeth still visible, forming small points on fused plate; outer row of four canines: three lateral pairs, posterior most smallest, anterior most largest; single anterior pair directed forward; lower jaw with fused row of teeth plus a separate anterior pair of canines; body elongate, depth 6.0 to 8.0 in standard length; head length 2.6 to 2.9 in standard length; snout long and compressed, its length 2.3 to 2.6 in head length.

Colour in alcohol: brown dorsally, ventral half lighter, but with some dark scales; fins grey or with transparent patches; some specimens with dark irregular spot on distal membranes of posterior dorsal spines.

Colour in life variable but basically green or red; fins with transparent patches and dark spot sometimes present on distal membranes of posterior dorsal spines.

Type species *Parodax caninis*.

Remarks

This genus is readily distinguished from other odacids on the basis of dentition. In addition to the normal fused teeth of the upper and lower jaws there are supplementary canines. The deeply notched dorsal fins and elongate, compressed snout are also distinctive.

Parodax caninis new species

(Fig. 6; Table 3)

Holotype: WAM P25346-002, 73.6 mm SL, Fremantle, between Carnac Island and Gage Roads, 21 metres, triangle dredge, J.K. Scott on the R.V. *Flinders*, June 30, 1975.

Table 3: Measurements of type specimens of *Parodax caninis* (in thousandths of the standard length).

	HOLOTYPE	PARATYPES				
	P25346-002	P25251-019	P25252-009	AMS I18627-001	P25343-010	P25498-001
Standard length (mm)	73.6	72.5	59.4	52.0	47.7	79.9
Depth of body	132	166	153	167	141	153
Head length	347	364	359	375	377	374
Snout length	145	159	148	146	138	179
Eye diameter	69	70	74	78	84	76
Bony interorbital width	64	83	66	83	80	76
Length of mouth	65	107	88	73	80	100
Least depth of caudal peduncle	64	84	71	85	69	76
Length of caudal peduncle	182	146	146	148	178	138
Snout to origin of dorsal fin	345	372	360	367	377	375
Snout to origin of anal fin	666	663	635	669	694	D*
Length of caudal fin	191	154	172	192	197	213
Length of pectoral fin	111	132	113	123	96	113
Length of pelvic fin	112	118	101	165	98	249
Length of first dorsal spine	87	74	77	86	128	124
Length of longest dorsal spine (3rd)	115	86	94	96	132	189
Length of shortest dorsal spine (11th)	32	28	30	19	34	66
Length of longest dorsal ray	91	82	72	85	90	98
Length of first anal spine	48	28	29	29	63	50
Length of second anal spine	68	57	59	58	86	65
Length of third anal spine	81	75	81	75	90	66
Length of dorsal fin base	501	500	473	478	490	D*
Length of anal fin base	179	180	185	175	174	190
Length of pelvic spine	99	63	74	75	90	75
Length of first pelvic ray	118	94	98	90	249	

D* = damaged



Fig. 6: *Parodax caninus*, 73.6 mm SL, holotype, Carnac Island, Western Australia.

Paratypes: WAM P25251-019, 72.5 mm SL, Rottnest Island, off south coast, 6 metres, spear, G.R. Allen, April 9, 1975; WAM P25252-009, 59.4 mm SL, Carnac Island, 8 metres, spear, G.R. Allen, April 6, 1975; WAM P25343-010, 47.7 mm SL, Fremantle, Gage Roads, 33 metres, triangle dredge, C. Bryce and L. Marsh on the R.V. *Flinders*, June 24, 1975; AMS I. 18627-001, 52.0 mm SL, Rottnest Island, off south coast, 6 metres, spear, G.R. Allen, April 9, 1975; WAM P25498-001, 79.9 mm SL, Rottnest Island, 3 km off S.E. coast, 15 metres, spear, J.B. Hutchins, December 24, 1975.

Description

(See also Table 3.) Dorsal rays XV to XVI, 12 to 13; anal rays III, 10 to 11; pectoral rays 12; pelvic rays I, 4; branched caudal rays 10, total caudal rays 18 to 21; pored lateral line scales 45 to base of caudal fin (one pored scale beyond base); gill rakers, short, triangular, 10 on first branchial arch.

Body elongate, the depth 6.0 to 7.6 in standard length; head length 2.6 to 2.9 in standard length; snout moderately long and pointed, 2.3 to 2.6 in head length; eye diameter 1.7 to 2.5 in snout length; interorbital space flat, the bony width 1.8 to 2.2 in snout length; least depth of caudal peduncle 1.7 to 2.2 in snout length.

Origin of dorsal fin slightly posterior to pectoral base; first dorsal spine 1.1 to 2.1 in snout length, just shorter than second spine; third, fourth and fifth rays longest and about equal; length of following dorsal spines decreasing to eleventh spine (4.1 to 5.7 in snout length), then remaining spines gradually increasing in length; first dorsal ray longest (just greater

than last dorsal spine), following rays decreasing slightly in length to sixth ray then increasing to tenth ray and finally decreasing to last ray; origin of anal fin below last dorsal spine; first anal spine greater than one half second anal spine which is less than the third spine; first anal rays longest, remaining rays decreasing in length posteriorly; dorsal and anal rays branched distally; pectoral fin rounded, its length 2.7 to 3.9 in head length, the tip reaching a vertical below fourth dorsal spine; pelvic fin length 2.9 to 3.8 in head length, its origin just posterior and below pectoral base; length of pelvic spine equal to second pelvic ray or slightly less than length of first pelvic ray.

Head and body scales cycloid; head naked except for an occasional two scales on preoperculum and two or three scale rows on operculum; lateral line continuous; no scales on fins except for sheath at caudal fin base; four longitudinal scale rows from first dorsal ray origin to lateral line; eight longitudinal scale rows from third anal ray origin to lateral line.

Upper jaw with two rows of teeth which fuse basally; inner row fused, individual teeth still visible, forming small conical points on the fused plate; outer row of four canines: three lateral pairs, posterior most smallest, anterior most largest; single anterior pair directed forward; lower jaw with fused row of teeth plus an outer separate pair of canines.

Head with numerous pores; a pair of small nostrils on each side of snout; posterior nostrils at upper anterior edge of eye; a pupil length to anterior nostrils, tubed with a small posterior flap; mouth small and terminal; lips moderately fleshy; preoperculum entire.

Colour of holotype in alcohol: light green with small dark spots on dorsal half; interorbital space with fine dark lines; dorsal fin grey with dark spot on distal portion of eighth to ninth spine; other fins grey. Colour of paratypes in alcohol identical except for the absence of dark spot on dorsal fin.

Colour in life: body green, becoming lighter ventrally; some darker green patches along lateral line, on caudal peduncle and at caudal fin base; head green-brown; snout and dorsal half of operculum with blue spots; ventral surface of head with irregular brown spots; lips pink; dorsal fin mainly green, membranes transparent on base of sixth to eighth spine and also tenth to twelfth spine, also red about base of ninth, thirteenth, fourteenth spine and from about sixth ray to the last ray; distal portion of last seven rays transparent; black spot present on upper membranes of eighth and ninth spine of dorsal fin of holotype; anal fin green to eighth ray, posterior portion transparent with red base; caudal fin green with red blotches on either side of middle; pelvic fins green; pectoral fins transparent.

The live pattern of a 47.7 mm SL paratype differed from the other types. The colours were as follows: body pink, becoming lighter ventrally;

side with silver band, extending from lower edge of eye to pectoral base, then continuing to caudal peduncle; dorsal portion of head red-brown with white spots; ventral region of head white with red spots; lips pink; indistinct red spots between pectoral and anal fins; small blue spots just above lateral line; base of dorsal fin red to fifth spine, remainder transparent; membranes on distal part of dorsal fin grey with red edges; anal fin red, grey distally; base of caudal fin red, remainder of fin with three areas of grey separated by white; pelvic fin grey with red patches, edges red; pectoral fins transparent.

One paratype, 79.9 mm SL, male, also differed and had the following colouration: body brown-green dorsally, yellow-green ventrally with a black patch on the ventral half of body from the start of anal fin to the caudal fin; body with four horizontal white lines with dark borders; dorsal portion of head green-brown, ventral portion of head yellow-green with two white lines with dark borders on snout, four white lines with dark borders on cheek and operculum continuous with lines on body; lips pink; dorsal fin yellow-green basally in spinous portion and posterior portion; red distally on spinous portion; first dorsal membrane blue with red and yellow spots encircled by black; from sixth dorsal spine to notch, orange spots border the basal side of a conspicuous black blotch; posterior half of fin with three horizontal blue lines edged in red; anal fin dusky-green, becoming yellow posteriorly, also with three horizontal blue lines fading posteriorly; caudal fin red-green with numerous small blue spots, dorsal and ventral tips dusky green; pelvic fin yellow-green basally, dusky green with black margins on rays; pectoral fin translucent, rays red.

Remarks

This species generally lives in association with seagrasses or algae on or between patches of reef. The six known specimens were captured at depths ranging from 6 to 33 metres.

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